

Hantavirus Pulmonary Syndrome

1. DISEASE REPORTING

A. Purpose of Reporting and Surveillance

1. To characterize the epidemiology and clinical aspects of this emerging disease.
2. To monitor disease trends and recognize outbreaks.
3. To target prevention and control messages.

B. Legal Reporting Requirements

1. Health care providers: notifiable to local health jurisdiction within 3 work days.
2. Hospitals: notifiable to local health jurisdiction within 3 work days.
3. Laboratories: no requirements for reporting.
4. Local health jurisdictions: notifiable to the Washington State Department of Health (DOH) Communicable Disease Epidemiology Section (CDES) within 7 days of case investigation completion or summary information required within 21 days.

C. Local Health Jurisdiction Investigation Responsibilities

1. Facilitate the transport of specimens to PHL for confirmatory testing.
2. Report all *confirmed* cases to CDES (see definition below). Use the hantavirus pulmonary syndrome report form (<http://www.doh.wa.gov/notify/nc/hantavirus.htm>) and enter the data into the Public Health Issues Management System (PHIMS).

2. THE DISEASE AND ITS EPIDEMIOLOGY

A. Etiologic Agent

Multiple hantaviruses have been identified in the Americas. Sin Nombre virus is the most important hantavirus in North America and is responsible for all of the cases identified in Washington.

B. Description of Illness

Hantavirus pulmonary syndrome (HPS) is an acute viral disease characterized by a relatively short (3–5 days) prodrome of fever, myalgias (muscle aches), headache, and gastrointestinal complaints followed by the abrupt onset of acute respiratory distress syndrome (ARDS) and hypotension. The illness progresses rapidly to respiratory failure with bilateral pulmonary infiltrates, pulmonary edema, and shock. Circulating immunoblasts (immature myelocytes), elevated hematocrit, and thrombocytopenia are almost always present; a rapid drop in platelets marks onset of the cardiopulmonary phase. About a third of all cases in the United States have died. In survivors, recovery from acute illness is rapid, but full convalescence may require weeks or months. Restoration of normal lung function generally occurs, but pulmonary function abnormalities may persist in some individuals.

C. Hantavirus Pulmonary Syndrome (HPS) in Washington State

Since the disease's recognition in 1993 through October 2007, there have been 34 reported cases of HPS in Washington State with 11 (32%) associated deaths. Between 1 and 5 cases occur annually with a geographic distribution throughout the state. The median age of cases in Washington State is 36 years (range 19–75 years). The death rate and median age of cases in Washington are similar to the national rates.

D. Reservoirs

The deer mouse (*Peromyscus maniculatus*) is the major reservoir of Sin Nombre virus in the western United States. Deer mice live in all parts of Washington, but mainly in rural areas. They usually carry the virus without showing any signs of being sick. The deer mouse is about six inches long from the nose to the tip of its tail. It is grayish to light brown on top, with a white belly, large ears and eyes, and a furry tail that is white on the underside.



Photo source: CDC website
<http://www.cdc.gov/ncidod/diseases/hanta/hps/>

Periodic rodent serosurveys were conducted by various organizations including Washington State University, the U.S. Navy, the U.S. Army, Walla Walla College, the U.S. Forest Service, CDC and DOH's Zoonotic Disease program from 1993 to 2001. During this time period, 14% of over 1,100 deer mice tested in Washington had antibodies against Sin Nombre virus. These data, as well as data from other states, also demonstrate that the percentage of infected mice may fluctuate widely from year to year.

E. Modes of Transmission

Exposure occurs by inhalation of aerosolized virus excreted in mouse urine, feces or saliva. Excreta may be aerosolized during cleaning of rodent nests or other activities. Exposures have occurred in rodent infested cabins, homes, barns, vehicles, outbuildings or less commonly when handling wild rodents without protective equipment. Transmission has rarely been documented from a bite of a deer mouse.

F. Incubation Period

One to six weeks (7–45 days).

G. Period of Communicability

Person to person spread of hantaviruses in the United States has not occurred. However, person to person transmission has been reported with an Argentinian hantavirus (Andes virus) causing a similar syndrome.

H. Treatment

Supportive care

3. CASE DEFINITION

A. Clinical Criteria for Diagnosis

An illness characterized by one or more of the following clinical features:

- A febrile illness (i.e., temperature greater than 101.0° F [greater than 38.3° C]) characterized by bilateral diffuse interstitial edema that may radiographically resemble ARDS, with respiratory compromise requiring supplemental oxygen, developing within 72 hours of hospitalization, and occurring in a previously healthy person
- An unexplained respiratory illness resulting in death, with an autopsy examination demonstrating noncardiogenic pulmonary edema without an identifiable cause

B. Laboratory Criteria for Diagnosis

1. Detection of hantavirus-specific immunoglobulin M or rising titers of hantavirus-specific immunoglobulin G performed or confirmed by a public health laboratory, or
2. Detection of hantavirus-specific ribonucleic acid sequence by polymerase chain reaction in clinical specimens performed or confirmed by a public health laboratory, or
3. Detection of hantavirus antigen by immunohistochemistry.

Note: Laboratory testing should be performed or confirmed at a reference laboratory. Because the clinical illness is nonspecific and ARDS is common, a screening case definition can be used to determine which patients to test. In general, a predisposing medical condition (e.g., malignancy, chronic pulmonary disease, trauma, burn, or surgery) is a more likely cause of ARDS than HPS, and patients who have these underlying conditions and ARDS need not be tested for hantavirus

C. Case Definition

Confirmed: a clinically compatible case that is laboratory confirmed.

4. DIAGNOSIS AND LABORATORY SERVICES

A. Diagnosis

Serology: Diagnosis is most commonly made by detection of virus-specific IgM in serum using an enzyme immunoassay (EIA). Most patients have IgM antibodies at time of hospitalization. An IgG test is used in conjunction with the IgM-capture test. Acute- and convalescent-phase sera should reflect a four-fold rise in IgG antibody titer. Note that acute-phase serum drawn as an initial diagnostic specimen may not yet have IgG. IgG antibody is long lasting once it develops, and sera of patients retrospectively identified appear to have retained antibody for many years.

Reverse transcriptase-polymerase chain reaction (RT-PCR) can be used to detect hantaviral RNA in fresh frozen lung tissue, blood clots, or nucleated blood cells.

Immunohistochemistry (IHC) testing of formalin-fixed tissues or paraffin-embedded tissues with specific monoclonal and polyclonal antibodies can be used to detect hantavirus antigens. IHC can be useful in fatal cases.

To date, no isolates of Sin Nombre virus-like viruses have been recovered from humans, and therefore virus isolation is not a consideration for diagnostic purposes.

There is no test for exposure to the virus. Persons concerned about exposure to rodent urine, droppings or nesting material should monitor themselves and seek medical care if they develop symptoms. In addition, there is no test to determine if the urine, droppings or nesting material are infectious.

B. Tests Available at the Washington State Department of Health Public Health Laboratories (PHL)

1. Enzyme immunoassay (EIA) for virus specific IgM and IgG antibody in serum.
2. RT-PCR and IHC are available through the CDC. All specimens being submitted to CDC *must* be sent through the PHL.

C. Criteria for Testing HPS Specimens at PHL

1. Patients with suspected hantavirus pulmonary syndrome (fever, hypotension, hypoxia, bilateral interstitial pulmonary infiltrates, ARDS, thrombocytopenia, hemoconcentration).
2. Any person with commercial laboratory evidence of HPS to confirm the positive test.

D. Specimen Collection***Serum***

1. Submit > 1 cc (2.5 cc preferred) of serum (separated serum, not whole blood) for EIA at PHL. Serum can be drawn upon hospital admission. If possible, also obtain as late a serum as available before death or hospital discharge, or a convalescent serum drawn approximately 21 days after the first specimen.
2. Specimens should be refrigerated and transported cold. Avoid repeated freeze-thaw cycles.
3. Specimens should be submitted by the clinical laboratory with a completed PHL Serology form (<http://www.doh.wa.gov/EHSPHL/PHL/Forms/Serology.pdf>) or Virology form (<http://www.doh.wa.gov/EHSPHL/PHL/Forms/VirusExams.pdf>).

Tissue, blood clots, or nucleated blood cells

For information on sending specimens to CDC for RT-PCR or IHC, consult CDES and visit: <http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/phys/specimen/specguide.htm>.

5. ROUTINE CASE INVESTIGATION**A. Evaluate the Diagnosis**

If the case tests positive for hantavirus at a laboratory other than a PHL, facilitate transport of the specimen (i.e., serum or tissue) to PHL for further testing. If a patient tests IgG positive and IgM negative for hantavirus at a commercial laboratory, this indicates possible past exposure and does not need any follow-up.

B. Identify Potential Sources of Infection

Obtain a history about possible exposure to fresh rodent urine, droppings, or nesting material. Exposures generally occur when urine, droppings, or nesting material are stirred up and inhaled. A rodent bite can also transmit the virus, however inhaling the virus is a much more common transmission route.

C. Identify Potentially Exposed Persons

It is very unusual to have multiple cases with the same exposure. However, other persons potentially exposed to the same source as the case should be educated about symptoms of HPS and told to seek medical attention if they develop such symptoms.

D. Environmental Evaluation

Notify local environmental health program of locally acquired cases. It may be appropriate to examine the environment where the case was exposed to make suggestions about rodent removal. However, since the deer mice are found throughout Washington and are identified as the reservoir for the Sin Nombre virus, testing rodents is not necessary at this time.

6. CONTROLLING FURTHER SPREAD

A. Infection Control Recommendations and Education

1. Hospitalized patients should be cared for using standard precautions.
2. Educate the case and/or others sharing the environment about avoiding future exposures (see Section 8B).

B. Managing Other Persons Potentially Exposed

Other persons who may have been exposed to the same source as the case should be educated regarding the signs and symptoms of HPS and told to seek medical attention if symptoms develop. HPS in Washington is not communicable from person to person. It is rare to have two cases sharing an exposure

7. MANAGING SPECIAL SITUATIONS

N/A

8. ROUTINE PREVENTION

A. Routine Vaccination: None

B. Routine Prevention

1. **Keep rodents out of your home and workplace.** Always take precautions when cleaning, sealing and trapping in rodent-infested areas.
2. **Seal up** cracks and gaps in buildings that are larger than 1/4 inch including window and door sills, under sinks around the pipes, in foundations, attics and any rodent entry hole.
3. **Trap indoor rats and mice** with snap traps.
4. **Remove rodent food sources.** Keep food (including pet food) in rodent proof containers.
5. **Clean up rodent infested areas:**
 - Wear rubber, latex, vinyl or nitrile gloves.
 - Do not stir up dust by vacuuming, sweeping, or any other means.
 - Thoroughly wet contaminated areas including trapped mice, droppings, nests with a bleach solution or household disinfectant. **Hypochlorite (bleach) solution:** Mix 1 and ½ cups of household bleach in 1 gallon of water. Use only freshly mixed solution.

- Once everything is soaked for 10 minutes, remove all of the nest material, mice or droppings with damp towel and then mop or sponge the area with bleach solution or household disinfectant.
- Spray dead rodents with disinfectant and then double-bag along with all cleaning materials. Bury, burn, or throw out rodent in an appropriate waste disposal system.
- Disinfect gloves with disinfectant or soap and water before taking them off.
- After taking off the clean gloves, thoroughly wash hands with soap and water (or use a waterless alcohol-based hand rub when soap is not available).

Please visit the CDC HPS prevention website for more information
(<http://www.cdc.gov/ncidod/diseases/hanta/hps/noframes/prevent.htm>)

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UPDATES